MOA Number: FNA/05-97-02 Effective Date: 9/25/97

MEMORANDUM OF AGREEMENT
between the
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
and the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
concerning
JOINT UNIVERSITY RESEARCH
IN AIR TRANSPORTATION

1. **PURPOSE:** This Memorandum of Agreement (MOA) establishes a cooperative research program concerning university air transportation research, under the existing FAA-NASA Memorandum of Understanding for Program Support.

2. **BACKGROUND:** Numerous research activities of mutual benefit to the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA) have been accomplished through the coordination of joint research and development efforts at academic institutions. The purpose of this agreement is to facilitate long-term joint research and development in aviation related technologies at universities between the signatory agencies. The initiation of new, as well as the continuation of existing university programs is envisioned under this agreement. An example of the latter is the FAA/NASA Joint University Program for Air Transportation Research. This program, now entering its twenty-fifth year, has been one of the principal vehicles for long-term, cross disciplinary civil aviation systems research in FAA and NASA. The participating institutions have pursued a diversity of research topics under these programs. Noteworthy examples include the investigation of navigational aids, satellite applications and avionics at Ohio University; flight control theory at Princeton University; and systems aspects of air traffic control, as well as aircraft icing at Massachusetts Institute of Technology (MIT). NASA Ames has conducted similar research programs with West Coast universities, most notably Stanford, in diverse enabling technologies of relevance to civil aviation.

3. **SCOPE/OBJECTIVE**: The scope of the research undertaken, being interdisciplinary in nature, will draw from all fields of the physical and computer sciences, mathematics, and engineering, but will be focused on several technical areas, described in section 4, of mutual interest to FAA and NASA.
The objective of this program is to provide access to, and dissemination of the long range, innovative research in civil aeronautics related technologies under development at American colleges and universities. A secondary benefit is the creation of a talented pool of graduates trained in engineering and scientific disciplines to advance the state-of-the-art in aviation technology in government, industry, and the academic community. A significant aspect of the training experience for these graduates is provided by the quarterly review process of this program. The graduate candidates prepare and present formal briefings on the goals, progress, and plans of their research projects. These presentations are then critiqued by their peers, university advisors, and government technical advisors at the quarterly reviews.

4. **AUTHORITY**: This MOA is entered into on behalf of NASA under the authority of the National Aviation and Space Act of 1958, as amended by 42 U.S.C. 2451 et seq., and on behalf of FAA as implemented under the Federal Aviation Administration Act of 1996, Public Law 104-264 (enacted October 9, 1996), Section 226(Contracts), (codified at 49 USC 106(l) and (m), the Federal Aviation Administration Research, Engineering and Development Act of 1990, Public Law 101-508, and the Aviation Security Improvement Act of 1990, Public Law 101-604. Further, this cooperative activity is established under the agreement for cooperation between the FAA and NASA concerning the FAA/NASA Coordinating Committee, signed by the Administrators on January 30,1990.

5. STATEMENT OF WORK:

A. TASK OUTLINE:

1. Research Areas:

The general joint activities and the specific research tasks covered by this agreement will involve one or more of the following areas of research:

a) System Capacity and Air Traffic Management (ATM)

Studies and research will be conducted to develop new concepts for increasing system capacity and improving the efficiency of ATM. These studies will include, but not be limited to: means for reducing aircraft separations in terminal areas; means for reducing runway occupancy times; means for improving all-weather aircraft braking and steering; means for improving runway and taxiway guidance systems; and means for developing decision support tools to help pilots, controllers, and system managers more efficiently manage air traffic.

b) Advanced Avionics, Controls, and Human Factors

Studies and research will be conducted to develop advanced concepts for civil transport and general aviation avionics, as well as controls to improve aircraft performance and capabilities in the evolving air traffic management system. Applied human factor studies will be conducted to assure optimum crew performance and reduce crew errors as the complexity of aircraft systems and the air traffic management system increase. Examples of studies in this general area include, but are not limited to: novel cockpit displays, electronic approach charts, "tunnel in the sky" approach aids, improved on-board flight management systems, and synthetic vision.

c) Aircraft Safety Research

Studies and research will be conducted to improve the safety and crashworthiness of all classes of civil aircraft. Studies may include the design and operation of aircraft systems, crashworthiness, environmental hazards to aircraft such as icing and windrotors/windshear, and aircraft stability and handling qualities. Examples of research to be conducted under this general area include: improvements to enhance aircraft stall/spin safety; the effects of heavy rain on aircraft and weather radar performance; the effects of new concepts for viscous drag reduction on aircraft performance and handling; and the prediction of aircraft structural performance under crash loads.

d) Aircraft Materials and Structures

Studies and research will be conducted to develop and test new aircraft materials and structural concepts to determine the performance for primary and secondary structural applications. Studies will include the determination of onset of fatigue, its characteristics, repair techniques, inspection techniques, and other information needed to assure the safety and airworthiness of civil aircraft employing these new technologies.

e) Satellite Technology

Studies and research will be conducted to examine specific elements of various concepts for satellite-based communications, navigation, and surveillance systems being studied by the FAA. Investigations may include, but are not limited to: modeling of Global Positioning System (GPS) transmission multipath interference; development of satellite earth coverage models; the design and flight test of on-board avionics for user aircraft; assessment of satellite system reliability and integrity; and the design and analysis of satellite and aircraft antenna systems.

f) Operations Research in Aviation

This area encompasses studies and research to explore more efficient methods for organizing and managing air traffic. Subjects included are airport design, operation of aircraft, air carrier operations, airspace design and air traffic procedures. Operations research techniques, including modeling, simulation, optimization and statistical analysis, will be applied to explore means for increasing capacity, reducing delay, improving fuel economy and, in general, improving the efficiency of aviation operations in ways applicable to real world operations.

2. NASA and FAA Responsibilities:

In view of the highly cooperative nature of the research tasks and their means of performance under this agreement, NASA Ames and the FAA Office of Aviation Research will consult with each other on a regular and continuous basis in regard to research efforts of mutual interest.

Grant awards to existing participating universities, as well as selection of, and awards to additional universities, for participation in the research and reporting tasks under this MOA, shall be made subject to the respective grant selection and award authorities of FAA and NASA. Solicitation, evaluation, selection, and award of grants for this purpose may be made jointly or singly by the respective agencies after mutual consultation.

The FAA and NASA shall conduct an annual review of the research under this MOA, to be held alternately at FAA Headquarters and NASA Headquarters. At these meetings, selected students may receive formal recognition as FAA/NASA Fellows, consistent with the directives and policy established for designating fellows in both agencies.

The FAA and NASA shall attend quarterly reviews at the participating universities to provide technical direction and program management of the research. The NASA Ames Research Center and the FAA Office of Aviation Research shall arrange, provide facilities for, and attend the winter quarterly review meeting in alternating years.

The FAA and NASA shall alternately prepare an annual program report and distribute copies of the report to program participants, government agencies, academic institutions and appropriate companies in the aviation industry.

B. RESOURCES:

A moderate commitment of personnel resources is anticipated on the part of FAA and NASA. Estimates of personnel man-hour loads are a combined total of several weeks per year for the FAA and NASA technical and administrative personnel.

C. SCHEDULE:

Four quarterly technical reviews will be held: A winter review will be held alternating each year between FAA and NASA Centers. Spring, summer, and fall reviews will be conducted at the participating universities on a rotating basis. Between the fall and summer reviews, an annual review shall also be conducted by FAA and NASA as stated in paragraph A.2. Participating universities shall submit research proposals to FAA and/or NASA no later than the end of each calendar year, and award via contract, grant or other agreement shall occur no later than March 31st each year.

An annual program report shall be published by FAA or NASA no later than December 31st, following the end of the preceding fiscal year.

D. REPORTS:

FAA and NASA will be provided a copy of the technical presentations from each quarterly review. It is the responsibility of the institution hosting the review to provide and disseminate these materials. NASA and FAA will compile and publish an annual report of all research conducted under this program, based upon information provided from the performing institutions.

F. FUNDING:

The funding profiles shown below reflect incremental funding through program completion and take all planned resources into consideration. Funding will be used for sponsorship of university research via one of a number of legal instruments, e.g. contract, grant, cooperative agreement, or other agreement, as well as for research and administrative expenses incurred by the FAA and NASA in execution of the program. The funding shown is for planning purposes only, and does not constitute authority to commit, obligate, or expend funds except as authorized by FAA and NASA officers authorized to enter into contracts, grants or other agreements on behalf of their respective agencies.

($ in thousands)*

	FY 97	FY 98	FY 99	FY 2000	FY 2001
FAA	150	150	150	150	150
NASA	150	150	150	150	150
Total	300	300	300	300	300

This MOA will not be used by itself as a funding document for the purpose of recording NASA and/or FAA transfer of funds. The transfer of funds documentation will, however, refer to this MOA as the basis for the transfer.

* Additional funding may be added from other FAA and NASA programs

G. **TECHNICAL REPRESENTATIVE (TR):** The following individuals are responsible for the oversight of this MOA at their respective centers; however, they do not have the authority to unilaterally alter any of the terms of this MOA. Any requests for changes shall be made in accordance with Paragraph 7, Amendments and Revocations. The Office of Record for this MOA is the FAA/NASA R&D Field Office at NASA Langley Research Center, Hampton, Virginia, AAR-210, (757/864-1905)

1. James H. Remer, FAA Technical Center, AAR-201, (609) 485-5653

2. Leonard Tobias, NASA Ames Research Center, AFA, (415) 604-5430

6. **PERIOD OF PERFORMANCE/TERMINATION:** The period of performance shall commence upon the upon the effective date of this MOA, and shall remain effective for five years. Either party may terminate this MOA 90 days after written notification of intent to terminate. Termination requires that the technical representative of the initiating party write a termination MOA (purpose section only) stating the MOA to be terminated, its identifying number, title, and effective termination date. The agency receiving funds under the original MOA will return any funds that have been advanced, but not expended, within 120 days of the terminination of that MOA.

7. **DISSEMINATION OF INFORMATION:** Rights in intellectual property, including rights in data produced under this agreement shall be stated in the terms of the funding instrument providing research support. It is the intent of FAA and NASA to allow data generated under this MOA to be in the public domain. NASA and/or the FAA may disclose or publish the results obtained from the performance of studies pursuant to this MOA, independently or jointly. The publishing party will, however, acknowledge and reference work performed by the other party and notify that party, in advance, of their intent to disclose/publish information resulting from work performed under this MOA.

8. AMENDMENTS AND MODIFICATIONS: All modifications to this MOA shall be in writing and shall be executed by the FAA and NASA signatories or their designated representatives, acting within the scope of their authority. Any major change in the work required under this MOA will be outlined, in detail. If the change falls within the scope of the MOA, it must be formalized by written, bilateral agreement between the FAA and NASA. If the change falls outside the scope of the MOA, the MOA must be modified accordingly and coordinated, approved and signed by FAA and NASA signatories. Any disputes that may arise under this Agreement will be resolved by the Technical Representatives(see Section 4.G, Technical Representatives) in accordance with and in compliance with appropriate FAA and NASA policies and procedures.

9. INTERPRETATION OR MODIFICATION: No verbal or written statement by any person other than NASA and FAA Headquarters signatories or their designated representatives, acting within the scope of their authority, shall be interpreted as modifying or otherwise affecting the terms of this MOA.

By our signature below, we hereby indicate our agreement to pursue research tasks as outlined in this MOA between the National Aeronautics and Space Administration and the Federal Aviation Administration on Joint University Research for Air Transportation.

APPROVAL:

Department of Transportation
Federal Aviation Administration

Dr. Jan Brecht-Clark
Acting Director, Office of Aviation Research

Date: 8-14-97

National Aeronautics and Space Administration

for Dr. Henry McDonald
Director, Ames Research Center

Date: 8/22/97

CONCURRENCE:

Department of Transportation
Federal Aviation Administration

for Dr. George L. Donohue
Associate Administrator for Research and Acquisitions

Date: 9/2/97

National Aeronautics and Space Administration

Dr. Robert E. Whitehead
Associate Administrator for Aeronautics

Date: 9/25/97

MEMORANDUM OF AGREEMENT
FAA/NASA JOINT UNIVERSITY PROGRAM

EXECUTIVE SUMMARY

This Memorandum of Agreement between the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA) formalizes, for a period of five years, a cooperative research program in air transportation technology. This research program, the Joint University Program (JUP), has existed for nearly twenty-five years, with FAA participation in JUP for over 15 years.

Justification for the program is to be found in the Federal Aviation Administration Research, Engineering and Development Authorization Act of 1994, Public Law 103-305, which directs the FAA to conduct joint research and development with other agencies, and in the Aviation Safety Act of 1988, Public Law 101-158, which directs the FAA to engage in research of a long term nature at a level which comprises at least 15% of the RE&D budget. The JUP is often the subject of congressional questions relating to these directives which arise frequently during the course of the annual FAA House and Senate budget hearings.

Under the JUP program, the FAA and NASA have jointly sponsored research at three universities: Massachusetts Institute of Technology (MIT), Princeton University, and Ohio University. An option is provided in this MOA to allow participation by other universities, by mutual agreement between FAA and NASA. JUP is unique in the high degree of collaboration between government sponsors and participants, and the university researchers. This includes setting research topics, evaluating grant proposals, and reviewing results via a series of quarterly reviews, and an annual FAA or NASA headquarters review. Grants to the institutions may be awarded by either the FAA or NASA. A formal joint FAA/NASA technical report is also published which summarizes the program's technical accomplishments over the preceding year.

The JUP is internationally recognized for the excellence of its world class research, and has received a score of awards, ranging from a majority of Radio Technical Commission for Aeronautics Jackson Awards, to Institute of Electrical and Electronics Engineers and American Institute of Aeronautics and Astronautics national research awards. Recently, the JUP was awarded the FAA's first national Excellence in Aviation Award. This MOA would continue that tradition of research excellence, and establish co-sponsorship with the NASA Ames Research Center.